

SERDP / ESTCP WORKSHOP

FEBRUARY 27 2008

MESSIER-DOWTY / HVOF IMPLEMENTATION

Direction / Reference / Date

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■■■■■ MESSIER-DOWTY, PRODUCTION FACILITIES

► **Bidos, France**

- Manufacturing centre for shock strut / shock absorber
- HVOF requirements on pistons for various programs
- M-D currently considering to invest into HVOF technology

► **Gloucester, United Kingdom**

- Manufacturing centre for axles / truck beam (bogie beam)
- HVOF requirements on axles for various programs

► **Toronto, Canada**

- Manufacturing centre for business, regional and military programs
- Assembly line for the B787 program
- HVOF requirements on a wide range of components
- One HVOF booth

► **Montreal, Canada**

- Manufacturing centre for cylinders (main fittings) on Airbus / Boeing commercial program
- HVOF requirements still in the early phase due to size of the components

► **Suzhou, China**

- Manufacturing centre for non complex components on various program
- HVOF investment being considered

■■■■■ MESSIER-DOWTY, HVOF REQUIREMENTS

► Existing programs

- Falcon 7X (Dassault) – Business program
- A380 Nose Gear- Commercial program
- A400M Main & Nose Gear – European military program
- B787 – Commercial program
- A350 Main Gear – Commercial program

► Every new program at Messier-Dowty will require HVOF coating as replacement to chrome plating whether it is a European or North American programs

► Still some exceptions on large components

- Internal small bores (micro gun ???)
- Internal diameter on cylinders (ID gun ???)
- Spigot (rotating equipment ???)
- OEM will require eventually such exceptions to be removed and converted to HVOF

■■■■■ MESSIER-DOWTY, GEOGRAPHY VS MARKET

► M-D located in 3 distinct geographic areas

- North America
- United Kingdom
- Western Europe

► European approach to HVOF technology

- HP technology (kerosene system) superior to LP technology (hydrogen system)
- Market dominated by Praxair JP 5000 / 8000 and / or SM Woka Jet 350 / 400
- Approval process strenuous for potential suppliers

► North American approach to HVOF technology

- Participation to HCAT
- LP technology and HP technology are comparable
- Simplification of the approval process for potential suppliers

► Approval process has been simplified

MESSIER-DOWTY, APPLICABLE SPECIFICATIONS

► HVOF THERMAL SPRAY – PCS 2560

- Application of tungsten carbide cobalt chromium coatings on metallic parts by High velocity oxygen / fuel (HVOF) process
- Largely inspired by AMS 2448

► QUALIFICATION PLAN FOR PCS-2560 SUPPLIERS

- Stipulates M-D approval process and commercial requirements

► HVOF POWDER – PCS 2561

- Tungsten Carbide Cobalt Chrome Powder, Agglomerated and Sintered
- 86 WC – 10Co – 4Cr
- Largely inspired by AMS 7882

► GRINDING REQUIREMENTS – PCS 4102

- Grinding of HVOF Sprayed Tungsten Carbide Coatings applied to Steel

MESSIER-DOWTY, HVOF REQUIREMENTS

FUTURE REQUIREMENTS

Sites	Number of parts		
	2008	2009	2010
Montreal	158	286	445
Bidos	204	381	596
Gloucester	1 750	3 600	6 200
Toronto	330	330	330
Suzhou		1 800	9 300
Total	2 442	6 397	16 871

Montreal	Main Fittings	A350 / A380 / B787
Bidos	Sliders	A350 / A380 / B787 / F7X / A400M
Gloucester	Pins	A350 / B787
Toronto	Main Fittings + Trailing Arm + Piston	F7X
Suzhou	Pins	B787

Excludes indirect requirements for A400M / A380 / F7X program.
Estimated to an additional 5 800 parts in 2010.

MESSIER-DOWTY, QUALITY SYSTEM REQUIREMENTS

► COMPLIANCE TO PRIDE MANUAL

- Process Requirements In Developing Excellence
- Stipulates Messier-Dowty quality requirements for suppliers

► AS 9100 APPROVAL REQUIRED TO BECOME M-D SUPPLIER

- EN 9100, AS9100 or JISQ9100
- Prerequisite to become a M-D approved HVOF spray supplier
- Immediate requirement

► NADCAP ACCREDITATION

- All special processes shall be certified NADCAP by target dates
- Target date for HVOF: December 31st, 2008
- Mandatory requirement from Boeing for B787 components

MESSIER-DOWTY, COMMERCIAL REQUIREMENTS

► SUPPLIER TO BE RESPONSIBLE FOR THE FOLLOWING ACTIVITY

- HVOF Thermal Spray per PCS-2560
- HVOF Grinding, Super Finishing and Inspection per PCS-4102
- Surface Texture Inspection per PCS-2565
- Magnetic Particle Inspection (MPI – if required) per PCS-3100 (or equivalent)
- Grinding and Super Finish could be sub-contracted by HVOF spray shop
 - Grinding source to be approved by Messier-Dowty
 - HVOF spray shop still commercially responsible for quality of products
- MPI could be sub-contracted to a M-D approved source

■■■■■ HVOF – SUPPLIERS REQUIREMENTS

► MESSIER-DOWTY ‘MAKE’ PARTS

- Messier-Dowty ‘MAKE’ parts are parts machined by M-D facilities. These parts are typically very large and heavy and require handling to manipulate
 - M-D BIDOS (France): Sliders or piston (Straight shape or T shape)
 - M-D Gloucester (UK): Axle (long cylindrical component) and truck / bogie beam
 - M-D Montreal (Can): Cylinders or Main Fittings
- M-D outsourcing requirements is only for HVOF spray since M-D already owns grinding equipment
- Even if M-D invest into HVOF technology, outsourcing will still be required

■■■■■ HVOF – SUPPLIERS REQUIREMENTS

► MESSIER-DOWTY ‘BUY’ PARTS

- Messier-Dowty ‘buy’ parts are components machined and assembled by M-D various suppliers
- Most of these suppliers do not have processing capability. Special process shall be conducted through approved M-D suppliers
- Several small suppliers with limited resources to manage sub-tiers.
- M-D would prefer to have ‘one-stop shop’ taking care of all operations:
 - Nital etch, MPI, shot peen, HVOF, grind, inspection, cad plating, paint, etc...
- Bare minimum: HVOF, grind, inspect & NDT

■■■■■ HVOF – SUPPLIERS REQUIREMENTS

► QUALIFICATION PROCESS

- Supplier to present a plan with minimum processing services
- Plan to be reviewed by M-D
- M-D lab and QA to audit suppliers to ensure that quality and processing are acceptable
- Design for experiment (DOE) to be completed by suppliers to demonstrate optimization and repetitiveness of spray parameters
- Supplier to procure material and machined to round axial specimens (ASTM-E-466)
- Supplier to spray the test samples
- Supplier to sub-contract samples testing to approved M-D laboratories
- Upon completion of the tests and acceptable results, notification of conditional approval to be sent by M-D
- Corrective actions from previous audits to be closed
- Final approval

■■■■■ HVOF – SUPPLIERS REQUIREMENTS

► ADDITIONAL QUALIFICATION PROCESS INFORMATION

- Approval process is material specific
 - Approval process for 300M is valid for low carbon steel and all stainless steel
 - Approval process for titanium
 - Approval process for Custom 465
 - A given supplier could pass its approval for steel substrate but fail for titanium substrate
- First few pieces to be coated and ground by a new supplier will have to be Rollscan
 - Barkhausen Noise Test
 - Activity to be done by supplier at its facility or at M-D facility
- Within 12 months of conditional approval, suppliers will be requested to purchase and install on-line monitoring equipment for thermal spray booths
 - Accura Spray
 - Spray Watch

■■■■■ MESSIER-DOWTY, LESSONS LEARNED

- ▶ Capacity available in the marketplace is limited
 - Lots of spray shop in the market
 - Capacity to meet aerospace reqs is more difficult than traditional spray market
 - Developing a good new supplier is a lengthy process
- ▶ Never split between spray source and grind source
- ▶ Consider spray and grind as two separate markets
 - Capacity problem is probably even more severe for grinding
 - Lots of grinding knowledge in the market for chrome
 - Transition from chrome grinding to HVOF grinding is not easy
- ▶ Start your supply chain development very early in the process
 - B787 program highlighted this need due to rapid program in monthly build-up rate
- ▶ Dedicate full-time resources to the assignment
- ▶ Preference for the one-stop shop concept

■■■■■ MESSIER-DOWTY, CONCLUSION

- ▶ Still looking for suppliers willing to embrace the challenge
- ▶ M-D business model calls for supply chain to grow
 - US dollar zone
 - Emerging countries (LC) zone
- ▶ Areas of development in dollar zone
 - West Coast
 - Mid-West
 - North-East
- ▶ Areas of development in LC zone
 - Mexico
 - India
 - China